

"BBN Job #41540"
Len Kleinrock
Tape #: 7
-- CARIBINER GROUP

QUESTION

LEN KLEINROCK

Looking back now at those days and my role there I feel a tremendous sense of gratification, pride, excitement, to have been part of what I consider to ... an experiment, a development, a technology, which will live on for hundreds and possibly thousands of years is something I never could have imagined in the time when I monkeyed around with a crystal radio set. It's just an unbelievable feeling of gratification, as I say, to have worked with those smart people to have contributed, to have had my ideas, in fact, implemented and ... and forwarded to create the students which pushed that theory forward and pushed the ideas. It's ... it's a kind of privilege I've had and something that you don't forget. It just

NCROFL@aol.com

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makes me very emotional every time I think about it.

QUESTION

LEN KLEINROCK

There's no question that the world has benefitted enormously from this technology. There's also a concern that this technology be used appropriately. We are now in a position where we depend upon technology. No one can turn off the Internet. Our stock markets depend upon networking. In some ways our national defense and national economy depend upon electronic funds transfer, movement of messages. We've reached the stage now where there's great benefit and the potential for enormous disaster if incorrectly handled, either by accident or on purpose. So there's an issue now of bringing to the population that use these networks the ethics and the social responsibility to use these things properly. We're in a world where terrorists can attack, where leaders can hopefully prevent that from happening. It's a dicey game these days and we've created something which is magnificent and yet has to be

handled carefully cause there's lots of chance for danger.

QUESTION

LEN KLEINROCK

My handle? Okay.

QUESTION

LEN KLEINROCK

Not exciting.

QUESTION

LEN KLEINROCK

There's ... there's one ...

(CUT)

QUESTION

LEN KLEINROCK

After that October 7th public demonstration the Net continued to grow dramatically. Ten, twenty, thirty, forty nodes, we had sixty-four nodes and came to a screeching stop until BBN expanded the address space and then it took off again. Now, in the mid-'70s, of course, this notion of packet switching was embraced by the commercial world. And Larry went on to form

Telenet Corporation, which tried to offer public packet switching, which is very difficult, by the way. Telenet didn't make a nickel until 1984. Meanwhile, more and more people are beginning to use the network. In the mid-'70s Bob Kahn was now running the Op(?) office. And he launched a project in packet radio and satellite packet switching. Actually Larry had started the satellite and Bob picked up on the packet radio. Suddenly we had other kinds of networks, a packet radio network, a satellite radio network and an ARPANET, which needed to be ... they needed to talk to each other. They used different protocols, they had different constraints. It was around that time that Vin Cerf(?) and Bob Kahn decided they needed a protocol, a suite of algorithms, which would allow very different networks to talk to each other. And they conceived of this transmission control protocol which allowed heterogeneous networks to talk to each other. And networks, which were fundamentally unreliable. So they build reliability and the inter-operability into their transmission control protocol. Then later the Internet

protocol came on, which allowed the internetting to take place and which allowed that very narrow definition which all networks have to, basically, install in their ... in their hosts to allow this very great ability to build new technologies underneath IP(?). TCP/IP was ... is a grass-roots effort, needed by the music community, most people adopted it, in spite of the fact that the IBMs and the DEC's were building their proprietary network stacks(?), TCP/IP was running the show. Now we began to get the science users involved. As I said, NSF had been supporting super computer development. A few super computer centers were built up and NSF decided to connect those super computers together with a high-speed backbone called the NSFNet. It was in their brilliant judgement to allow that network to open up and allow others to use it as well. And so the NSFNet became the backbone, first of all, for the set of networks which now became ... became called the Internet. And at the same time many other users came in. The Scientuse(?) had an enormous accessibility to this

network. And so the ARPANET use, now called the Internet, left the computer science community, expanded out to the general scientists, physicist, chemist, biologist, geologists, etcetera. The use then began to mushroom. And the ... and more and more people attached. More and more kinds of networks attached. And the Internet began to grow internationally. Just a couple of years ago, as the Internet began to grow the commercial world said, look, why should the government be providing free service to all these scientists? There's a business there and the government is prohibiting us from entering that business. It's unfair advantage. So pressure was put on NSF and they promptly began to back off and allow the commercial groups to come in.

(OFF MIKE)

(CUT)

(OFF MIKE)

LEN KLEINROCK

As the use by the science world expanded the commercial vendors began to notice there's a business

here selling networking. And so pressure was put on NSF to stop offering this free service, which, basically, prohibited the commercial people from entering the marketplace. And NSF, to its credit, began to back off and the commercial world began to enter. Now, as soon as that happened many, many commercial groups began to use the Internet for business purposes. At that point we began to see the entertainment and the telephone and the cable TV companies recognizing there is a business here. And that brings us to the point where the billions of dollars in investment to bring five hundred channels of TV to you has been motivated. The ability for the marketplace to come in and sell that service.

QUESTION

LEN KLEINROCK

As an example of the ... of the delicious power and the ... the ... the wonderful spontaneous generation of services and activities in the Internet ... I'll give you just one ... one example. I have five telephone lines coming into my house. Don't ask why. And I have a

lot of telephone jacks and I have twelve wires down to my basement from every telephone jack. And I wanted to get a PBX to run this system for me. It's highly technology oriented. And I had carefully selected a digital Panasonic PBX to buy. I went through all the specs and it fit just what I wanted. And before I purchased it I figured, why not check the Internet bulletin board and see what those guys say. So I posted a comment saying, here's my application, here's my environment, here's the machine I want and here's what I want to do with it. And within hours I got a dozen messages come back saying, don't buy the digital, buy the analog. Digital doesn't work well, it's good for Japan but not the States. And the analog is ... I bought the analog and I was pleased. That's the kind of ... I ... there's no way I could have done that kind of research on my own. There's a world of information out there at your fingertips and it's free.

(OFF MIKE)

(CUT)

LEN KLEINROCK

There is an interesting sub-culture that lives on the Internet, which I found out about three or four years ago. I found out that most of my graduate students are spending most of their time reading news groups. And news groups and news groups. Now, two years ago I decided to buy a PBX. I have five telephone lines coming into my house and I'm heavily wired and I wanted to get a PBX to control those five lines. So I carefully researched the magazines and I decided, I need a digital, Panasonic PBX. But before I purchased it, I figured I'll take advantage of these news groups too. So I posted a message on the appropriate communications equipment news group and I told them what my application was, what my environment was, what I wanted to do with it and what equipment I had selected. Within hours I got back ... back got back a dozen responses saying, no, no, no, don't buy the digital, buy the analog. The digital won't work well in the States, it doesn't have all the features you want, the analog has been around, it works well, I bought the analog. All that information is available in

almost any possible variety of topics you can imagine. And most of it's for free. This world ... this ... this ability to provide networking capability, people to people interaction, is ... is spawning things. It's the Web, Mosaic, Gofer, things that you can't imagine. You've got to let it happen. And that's what the Internet is providing us.

(OFF MIKE)

(CUT)

(OFF MIKE)

QUESTION

LEN KLEINROCK

Here we are twenty-five years after the birth of the ARPANET, parent of the Internet, and we're about to explode into the consumer ... into the business, into the home world. The education world. The fact is we have no idea what the killer application is gonna be for this technology. Well, what might it be? What kinds of things could happen? Well, you know, a network has a number of capabilities. It has speed, yeah, we can move billions of bytes per second. It has

intelligence, yes, the network knows what's going on. You know, it used to be when you turned on your radio the radio didn't know you were listening to Tchaikovsky and your TV doesn't know you're watching Jay Leno. Now networks know what you're doing. We have intelligent networks. They know what you're number is that you dialed in from, they know your credit rating, they know your past history. So the network has intelligence. It has speed. The thing it doesn't yet have is the ability to take action, to manage your affairs, to provide educational tools, dynamically adjusted or customized to the needs as you go along. So I can imagine years from now that there'll be a ... an environment alive with intelligent networking, computing capability. Thousands of small computers, microprocessors, imbedded in your environment, which is serving you. And what can they do? They, hopefully, can provide the appropriate educational capability to you in a classroom without walls. They can provide medical aid. They can manage your affairs, conduct commerce, run our

national economy, do all those things that, in fact,
intelligent action-enabled systems can do for you.

(OFF MIKE)

(END OF TAPE 7)